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The following communications were read:—

I. On the transit of *Mercury* which took place on the 5th instant.

1. *Greenwich.*—The Astronomer Royal obtained a very satisfactory observation of the immersion of the centre. The instrument selected was the eastern (or Sir George Shuckburgh's) equatorial, furnished with a beautiful double-threaded micrometer by Dollond. The sun's limb was made to run along the equatorial wire of the instrument, and the movable wire was adjusted to the path of *Mercury* as nearly as possible, by a previous calculation of Mr. Richardson. So nearly was this operation performed, that on the momentary appearance of the planet it was almost bisected by the wire. The versed sine of the chord thus measured by the micrometer was found equal to $2'\ 34''{,}5$, the mean time of internal contact $21^h\ 2^m\ 55^s{,}76$, and the diameter of *Mercury*, by a mean of 3 measures, $11''{,}38$.

Mr. Simms, of the Royal Observatory, remarks, "I did not see *Mercury* till after the external contact, and immediately observed two arms of light extending from the sun and forming round the planet, and at length the whole of his disk became visible, before the internal contact was complete. I afterwards observed, that immediately round the planet there was a dusky tinge, making it appear as if, in a small degree, sunk below the sun's surface; I compared it in my mind at the time, to a piece of coin pressed hard upon an elastic sphere."

Mr. Simms also gives a sketch of the appearance of *Mercury* on the sun, in which the planet is surrounded by a halo.

2. *Greenwich Hospital, Long.* $0^s{\cdot}8$ W., *Lat.* $51°\ 28'\ 52''$ N.—Mr. Riddle observed *Mercury* completely on the sun's disc, rather within, at $21^h\ 3^m\ 53^s$. "I directed my attention particularly to observe whether round the little black patch there was any shade which might be supposed to be produced by the planet's atmosphere, and my impression is, that the appearance of the solar disk round the planet was such as an atmosphere might be expected to produce. Vision in my telescope was very distinct, but still, from its limited power, it is quite possible that the appearances which I noticed might be illusory."

3. *Observatory, Exchequer Street, Dublin, Long.* $25^s{\cdot}4$ W., *Lat.* 53° 20′ 56″ N.—The sun's centre was on the meridian at $2^h\ 50^m\ 24^s{,}15$, and that of *Mercury* at $2^h\ 50^m\ 9^s{,}9$. The clock error was $25^s{,}30$ fast, and rate $0^s{,}2$ daily.

4. *Fleet Street.*—Mr. Simms obtained from two micrometrical measures 10″,89 and 11″,55, for the diameter of *Mercury*. Of these, he prefers the second.

II. Observations of the Occultation of *Saturn* on the 8th instant.

1. *Greenwich Naval Hospital.*—By Mr. Riddle.

	h m s
Immersion of the west limb of *Saturn* ...	9 6 11,5
Ditto east ditto ditto	7 7,0
Ditto east end of the ring	7 38,0

2. *Islington.*—By Mr. Simms. Achromatic $5\frac{1}{2}$ feet, aperture $3\frac{3}{4}$, power 160.

Immersion.	h m s	Emersion.
Western extremity of ring ...	12 12 1,0	
Western limb	12 12 22,0	
Eastern limb	12 13 2,0	$13^h\ 12^m\ 59^s{,}3$

E. extreme ring obscured by cloud.

The immersion was remarkably beautiful, not the slightest distortion, projection, change of colour, or diminution of light, was evident. The moon's dark limb perfectly sharp and well defined upon the body of *Saturn*, which disappeared with a steady and uniform motion. At emersion the planet was but dimly seen; its form, however, was perfect, and its motion regular.

3. *Bedford.*—By Captain Smyth.

	h m s
Preceding limb of *Saturn's* ring touched by the dark disk of the moon.....	12 09 39,12
Preceding limb of *Saturn*	12 09 57,72
Following limb of *Saturn*	12 10 59,22
Following limb of the ring	12 11 25,12

4. *Lapley, near Brewood, Staffordshire.*—By the Rev. M. Ward.

Sidereal. h m s	
12 0 0,18	Leading ansa of *Saturn's* ring touched the moon's limb; the sky perfectly clear.
12 0 40,18	Ansa completely occulted, a thin film then passing.
12 1 6,18	Complete occultation of the body of *Saturn;* the film increased.
12 1 44,18	Complete occultation of extreme point of following ansa; the film increased and become yellow; in a few minutes the moon was obscured by clouds, and continued so nearly half an hour.
13 0 40	A very faint light, resembling the light in the moon's disc called Aristarchus, about twice as broad as the ansa, but not in the least defined. While adjusting the focus of the telescope the body of the planet appeared, and in the mean time the edge of a dense cloud passed, and at
13 1 50	The cloud had passed away, leaving the sky perfectly clear, and the edge of the planet about a whole diameter of the ring distant from the moon.

The first three observations must, from circumstances, be taken with allowance for estimation. The fourth was the instant of disappearance, together with its decimal. The estimation of a portion of a second, and the quantity of immersion, might have appeared to another observer, with a superior instrument, somewhat different in the first three observations. The faint light, or dawn-like appearance of the fifth observation, leaves the time the planet was occulted subject to some uncertainty.

III. Observations of the Occultation of 119 and 120 *Tauri*, March 9, 1832, at Islington. By Mr. Simms.

The night was remarkably fine, and the dark limb of the moon distinctly visible, the disappearance of the star 119 perfectly instantaneous, and in about 36 minutes of time 120 was in contact with the limb; the star appeared first to shoot forward a distance equal to about twice its own apparent diameter within the moon's border, and in this situation, after declining and reviving in brilliancy several times, gradually faded out of sight: a period of 12 seconds elapsed between the time when its occultation was expected and that when it actually occurred.

Mr. Simms is inclined to attribute the phenomenon of projection to local circumstances partially distributing upon the surface of the moon a medium of great refractive power.

IV. Correction of the Formulæ for determining the Longitude from an observed Occultation, with Suggestions for simplifying the Application of these and other Formulæ to the case of corresponding Observations. By Mr. Riddle.

In a former paper (See *Memoirs*, Vol. IV. Part II.), Mr. Riddle had employed the co-ordinate of the parallax, in the direction of the star's polar distance, for correcting the geocentric place of the point on the lunar disk at which the star was occulted. But, in dealing with a parallax so large as that of the moon, this co-ordinate may differ too sensibly from the true correction. Mr. Riddle gives the following quantity x'', to be added to the correction aforesaid when the star's declination is north, and substracted when it is south:

$$\text{Log. } x = 2 \text{ Log. } b + \text{Log. cot. } a + 4{\cdot}384545;$$

where a is the north polar distance to be corrected, and b is the number of seconds in the perpendicular let fall from the true point of occultation upon the hour circle of the same point, affected by parallax; no sensible error arising from using an arc of a great circle instead of the corresponding parallel of declination.

Mr. Riddle annexes a table from which the same correction may be found by inspection.

V. Observations of Eclipses of *Jupiter's* Satellites, and Occultations between the years 1827 and 1832, and Measures of Double Stars taken in 1831 and 1832. Also, Observations of the Comet of Ophiuchus, in Jan. 1831. By the Rev. W. R. Dawes, communicated by Sir J. F. W. Herschel.

Mr. Dawes has not been able to notice any projection on the moon's limb. On the occultation of *Jupiter*, June 1, 1831, he remarks:—"The satellites did not appear *instantaneously* at their full brilliance. From the instant when the emersion of *Jupiter* commenced, its size was beautifully defined, being uniformly bright, and perfectly free from distortion up to the very limb of the moon, in which several minute irregularities were visibly projected on the limb of the planet."

Mr. Dawes obtained the following observations of the comet:

	Mean Time.	
Jan. 24th	$18^h\ 25^m$	Dec. $7°\ 0'\ 24''$ S.
	$19^h\ 0^m$	Æ $16^h\ 19^m\ 23^s$
25th	$18^h\ 52^m$	Dec. $6°\ 34'\ 40''$ S.
	$19^h\ 3^m$	Æ $16^h\ 14^m\ 30^s$

VI. A New Method of Reducing the Apparent Distance of the Moon from a Star to the True. By Baron Zach.

This method consists in applying to the apparent distance four corrections, as follows: Let D be the apparent distance; A the mean of the apparent and true altitudes of the star; a the same of the moon; C and c the difference between the true and apparent altitudes of the same; and let $S = D + A + a$. Let d and e be found from the following equations:

$$\sin d = \frac{\cos \frac{1}{2} S \sin (\frac{1}{2} S - a)}{\sin D \cos A} \sin C$$

$$\sin e = \frac{\cos \frac{1}{2} S \sin (\frac{1}{2} S - A)}{\sin D \cos a} \sin c$$

Then, true distance $= D + C - c - d + e$.

The result is considered by Baron Zach as sufficiently near for the purposes of navigation; if, however, greater precision be required, let the first approximation be $D - R$, and repeat the process after diminishing $\frac{1}{2} S$, $\frac{1}{2} S - a$, and $\frac{1}{2} S - A$ respectively, by $\frac{1}{4} R$, and D by $\frac{1}{2} R$. The second result will not differ by $1''$ from that of the exact trigonometrical formula. Baron Zach gives eight instances of the results of his first approximation, five of which do not differ from the truth by $1''$, the errors of the other three being $+1''$, $-1''$, and $+4''$.

VII. A Method of Finding the Rate of Variation of the Moon's Motion at any instant. By Lieut. Raper.

Since the velocity at any instant is the limiting ratio of the increment of y (the right ascension, for instance) to that of t, the time, it is the value of $\frac{dy}{dt}$ obtained from the series expressing the right ascension by differences; and therefore finding the velocity amounts to drawing a tangent to a curve, whose ordinates proceed by differences, stopping at the mean second difference as near enough. It appears, hence, that when the time is near 6^h the change in Æ, &c., is a proportional part of the difference for 12^h; that the velocity so computed per minute or second holds good for 12^m of time at least, in all cases, without introducing an

error of 0″.1—; and that the error varies nearly as the square of the time.

VIII. On the Determination of the Solar Parallax, from Observations of the Transit of Venus, June 3, 1769. A posthumous work of Don Joseph Joachim de Ferrer; followed by a Summary by Don Joseph Sanchez Cerquero. Communicated by Sir James South.

Don J. J. Ferrer has collected all the memoirs which appeared on this subject, and has entered into a particular discussion of each. He calculated the differences of longitude between the places of observation by the eclipse of the sun and transit of *Mercury* of the same year. The mean equatorial parallax deduced from the whole he considers as 8″,58, without the possibility of a greater uncertainty than 0″,03. He concludes with a table of longitude deduced from the different observations. There is also a table of the observed differences in time between the coincidences of the limbs and the formation or breaking of the luminous thread, which, by a mean of 20 observations, is 34″,1, but with great variations.

The results obtained by Euler, Hornsby, Pingré, Du Sejour, Lexell, La Lande, and Maskelyne, are so different as to leave the parallax uncertain within 0,″35. M. Ferrer shews that these "differences arise sometimes from errors committed by them in their calculations, sometimes from employing observations the inaccuracy of which would have been readily discovered if all had been calculated, and sometimes from confounding in the observations the moments of internal contact with those of the formation or breaking of the luminous thread."

"The complete duration of the transit of *Venus* was observed in the following places:—Cape Wardhus, Kola, Cajaneburgh, Otaité, Fort Prince of Wales, on the North-west coast of Hudson's Bay, and at St. Joseph and St. Anne, in California.

"The *ingress* of the planet was seen in almost all the observatories of Europe, and the *egress* at St. Petersburg, Takutsk, Manilla, Batavia, Pekin, Gurief, Orska, and Oremburg."

In the discussion of the particular observations there is not much that can be usefully separated from the rest. Subjoined is the criticism of M. Ferrer on the observations and deductions of Père Hell, at Cape Wardhus.

"It is known that the Père Hell did not publish his observations till six months after they were made, and that he defended himself from the charges brought against him by astronomers of the time, by saying, that as he had made the observations under the patronage of the King of Denmark, he thought himself obliged to offer them to his majesty previously. However that may be, it is certain that some persons rejected these observations, while others adopted them as very exact.

"I have remarked, that the end of the solar eclipse, which is asserted to have been very accurately observed at Wardhus, is different from that which is deduced from the formation of the luminous thread at the ingress. It also appears from a mean of 20 results, which I shall insert hereafter, that the difference of time

between the coincidences of the limbs and the formation or rupture of the luminous thread is $34^s,1$, while, from the preceding observations, it would appear to be $8^s,3$ at the ingress and 9^s at the egress. Besides this, another contradiction may be noted in what the Père Hell says relative to the interior contact at the egress. In effect, this astronomer says, ' that he observed a black drop or spot, " gutta nigra," formed between the dark limb of *Venus* and the bright limb of the sun at $15^h\ 27^m\ 24^s,6$; at $15^h\ 27^m\ 30^s,6$ this drop momentarily disappeared, and, as it were, diffused itself, and the limbs of the sun and *Venus* joined together, and so formed the internal optical contact at $15^h\ 27^m\ 35^s,6$. This internal contact was so instantaneous, that, in the opinion of the Père Hell, it was exact to a second of time.'

" By this relation it would seem that the observation deemed important by the Père Hell was the coincidence of the limbs, which he calls the optical contact, and not the formation of the drop. The other observers at Wardhus contented themselves with observing this optical contact, without determining when the luminous thread was broken.

" The incomprehensible part of this account is, how, after the drop was formed at the egress, it should so suddenly disappear, and the contact of the limbs take place without the uncertainty of a single second. That which is truly instantaneous is the formation or breaking of the luminous thread when the drop was formed, which does not disappear in the coincidence of the limbs, whence the observations of the contacts are more doubtful than the formation or breaking of the luminous thread.

" It should also be observed, that in the dissertation of the Père Hell upon the sun's parallax, he adopted the moment of the formation of the drop, $15^h\ 27^m\ 24^s,6$, for that of the optical contact, having forgotten what he had said in his first dissertation."

IX. An Ephemeris of Encke's Comet for the Southern Hemisphere. By Professor Encke. Communicated by Lieutenant W. S. Stratford. This Ephemeris is founded on the subjoined elements, which are deemed more accurate than those inserted in the Supplement to the *Nautical Almanac* for 1832. It contains, for every day, from May 18,3 to August 16,3, 1832, the right ascension and declination, to the tenth of a second, with the horary motions to the hundredth of a second, and the log. distance of the comet from the earth to five places of decimals. Professor Encke also gives the corrections for the perturbations for every fifteenth day; and corrections for aberration and nutation, together with the log. of the radius vector, for every fifth day.

Elements.

Epoch, 1832, May 4,0. Paris Mean Time.		
Mean Anomaly.....	0° 0′ 20″,86	
Mean Diurnal Motion.....	1071,32651	
Long. of the Perihelion	157° 21′ 32″,2	from Mean Equinox
——— Node	334 32 4,1	of May 4.
Inclination	13 22 12,3	
Angle of Excentricity	57 43 17,0	
Log. of the Semi-axis major..	0·3467232	

X. A List of Stars observed with the Moon at the Royal Observatory, Greenwich, in the month of April, 1832.

		Transit Clock. h m s	Daily Rate of the Clock.
April 8.	3 Cancri	7 51 53,50	
	☽ 1 L.	7 59 56,36	+ 0s,26
	ℓ Cancri	8 22 46,76	
	δ Cancri	8 35 52,00	
9.	ℓ Cancri	8 22 44,86	
	δ Cancri	8 35 52,06	+ 0s,14
	☽ 1 L.	9 0 43,92	
	7 Leonis	9 27 26,26	
10.	7 Leonis	9 27 26,28	+ 0s,13
	☽ 1 L.	9 59 9,42	
11.	ε Leonis	10 24 42,44	
	ζ Leonis	10 41 10,30	
	☽ 1 L.	10 55 4,14	− 0s,21
	ν Virginis	11 37 58,50	
April 13.	τ Virginis	12 1 49,80	
	(142) Virginis	12 30 33,40	− 0s,20
	☽ 1 L.	12 40 50,26	
	k^4 Virginis	12 56 0,38	
14.	☽ 1 L.	13 31 53,76	
	88 Virginis	13 40 15,96	− 0s,24
	94 Virginis	13 58 9,34	

XI. Observations of the Moon and Moon-culminating Stars, made at Cambridge Observatory, in the month of April, 1832. Long. 23s,54 E., Lat. 52° 12′ 50″.

Day.	Names.	Clock time of Transit. h m s	Clock's losing rate. s
April 8.	3 Cancri	7 50 16,94	1,41
	Moon 1 L.	7 58 18,87	
	ℓ Cancri	8 21 8,32	
	δ Cancri	8 34 15,59	
9.	δ Cancri	8 34 14,28	1,29
	Moon 1 L.	8 59 5,12	
	7 Leonis	9 25 48,34	
11.	ε Leonis	10 23 2,19	1,21
	ζ Leonis	10 39 30,02	
	Moon 1 L.	10 53 22,97	
13.	τ Virginis	12 0 7,46	1,27
	(142) Virginis	12 28 51,09	
	Moon 1 L.	12 39 7,03	

1832. March 8. Disappearance of *Aldebaran* at the moon's dark limb, at $11^h\ 9^m\ 20^s,65$ Cambridge sidereal time.

J. Moyes, Castle Street, Leicester Square.